

WE CLAIM:

- 1       1. A nanocomposite reinforced polymer extruded into a tube  
2                having 0.001 inches to 0.500 inches inside diameter for  
3                use in an intravenous catheter.
- 1       2. A reinforced polymer blend formed by extruding a  
2                nanocomposite polymer with a pure virgin copolymer into  
3                tubing having an inside diameter of 0.001 to 0.500  
4                inches.
- 1       3. A reinforced polymer blend as defined in Claim 2  
2                wherein said nanocomposite polymer includes  
3                nanoparticles therein.
- 1       4. A reinforced polymer blend as defined in Claim 2  
2                wherein said pure virgin copolymer comprises a reacted  
3                plastic material formed from a mixture of at least two  
4                individual component polymers in order to provide the  
5                reinforced polymer blend with at least some mechanical  
6                properties attributable to each of said individual  
7                component polymers.
- 1       5. A reinforced polymer blend as defined in Claim 2  
2                wherein said nanocomposite polymer and said pure virgin

3 copolymer share a common chemical segment and matrix.

1 6. A reinforced polymer blend as defined in Claim 2  
2 wherein said nanocomposite polymer and said pure virgin  
3 copolymer both are based upon thermoplastic polymers  
4 having the same crystalline chemical form.

1 7. A reinforced polymer blend as defined in Claim 2  
2 wherein said pure virgin copolymer is added to said  
3 nanocomposite polymer in metered amounts to  
4 predetermine the mechanical properties of the resultant  
5 reinforced polymer blend so formed.

1 8. A reinforced polymer blend as defined in Claim 7  
2 wherein said nanocomposite polymer and said pure virgin  
3 copolymer share a common chemical family and matrix to  
4 enhance predictability of the mechanical properties of  
5 the resultant reinforced polymer blend so formed.

1 9. A reinforced polymer blend as defined in Claim 2  
2 wherein said pure virgin copolymer includes Nylon and  
3 said nanocomposite polymer include Nylon.

1 10. A reinforced polymer blend as defined in Claim 9  
2 wherein said pure virgin copolymer includes Nylon 6 and  
3 said nanocomposite polymer includes Nylon 6.

1       11. A reinforced polymer blend as defined in Claim 9  
2           wherein said pure virgin copolymer includes Nylon 11  
3           and said nanocomposite polymer includes Nylon 11.

1       12. A reinforced polymer blend as defined in Claim 9  
2           wherein said pure virgin copolymer includes Nylon 12  
3           and said nanocomposite polymer includes Nylon 12.

1       13. A reinforced polymer blend as defined in Claim 9  
2           wherein a series of decreasing durometer blends are  
3           produced with similar melting points for advantages in  
4           forming composite guide catheters.

1       14. A reinforced polymer blend as defined in Claim 7  
2           wherein the mechanical properties of the resultant  
3           reinforced polymer blend are intermediate between the  
4           mechanical properties of the pure virgin copolymer and  
5           the nanocomposite polymer.

1       15. A reinforced polymer blend as defined in Claim 8  
2           wherein at least some of the mechanical properties of  
3           the resultant reinforced polymer blend are higher than  
4           the same mechanical properties of the pure virgin  
5           copolymer and the nanocomposite polymer.

1       16. A reinforced polymer blend as defined in Claim 15  
2               wherein the mechanical properties include stiffness.

1       17. A reinforced polymer blend as defined in Claim 15  
2               wherein the mechanical properties include dimensional  
3               stability.

1       18. A reinforced polymer blend as defined in Claim 15  
2               wherein the mechanical properties include outer  
3               surfaces with more lubricity with reduced tendency for  
4               dust contaminants to adhere thereto.

1       19. A reinforced polymer blend as defined in Claim 15  
2               wherein said mechanical properties include outer  
3               surfaces with enhanced lubricity for ease of catheter  
4               placement and movement.

1       20. A reinforced polymer blend as defined in Claim 15  
2               wherein the mechanical properties include ductility.

1       21. A reinforced polymer blend as defined in Claim 2  
2               wherein said pure virgin copolymer is nylon based.

1       22. A reinforced polymer blend as defined in Claim 21  
2               wherein said nanocomposite polymer is polyamide-based  
3               to form a resultant reinforced polymer blend which is

4 also polyamide-based.

1 23. A reinforced polymer blend as defined in Claim 21  
2 wherein said nanocomposite polymer is polyester-based  
3 to form a resultant reinforced polymer blend which is  
4 also polyester-based.

1 24. A reinforced polymer blend as defined in Claim 2  
2 wherein said nanocomposite polymer includes 1% to 10%  
3 by weight of nanoparticles with Nylon 12 and wherein  
4 said pure virgin copolymer comprises Nylon 12.

1 25. A reinforced polymer blend as defined in Claim 24  
2 wherein said Nylon 12 pure virgin copolymer is added to  
3 said nanocomposite polymer in pre-specified amounts in  
4 order to predetermine hardness of the resultant  
5 reinforced polymer blend so formed.

1 26. A reinforced polymer blend as defined in Claim 4  
2 wherein the resultant reinforced polymer blend so  
3 formed is transparent.

1 27. A reinforced polymer blend as defined in Claim 4  
2 wherein the resultant reinforced polymer blend so  
3 formed is at least partially translucent.

1       28. A reinforced polymer blend as defined in Claim 4  
2                wherein the resultant reinforced polymer blend so  
3                formed is opaque.

1       29. A reinforced polymer blend as defined in Claim 7  
2                wherein the cooling down time for the resultant  
3                reinforced polymer blend is increased.

1       30. A reinforced polymer blend as defined in Claim 7  
2                wherein the resultant reinforced polymer blend is  
3                cooled down in a temperature controlled environment  
4                having an increased temperature in order to improve  
5                ductility and dimensional stability thereof.

1       31. A reinforced polymer blend as defined in Claim 7  
2                wherein the resultant reinforced polymer blend is  
3                cooled down in an ambient air environment.

1       32. A reinforced polymer blend as defined in Claim 7  
2                wherein the draw down ratio is increased to increase  
3                the final stiffness of the resultant reinforced polymer  
4                blended material.

1       33. A reinforced polymer blend as defined in Claim 7  
2                wherein the nanocomposite polymer increases the  
3                adherence of ink used for printing on the exterior of

4           any product formed from the resultant nanocomposite  
5           reinforced polymer blend material.

1       34. A reinforced homopolymer nanocomposite material with  
2           prespecified strength parameters controlled by the  
3           metered amount of pure virgin copolymers added thereto  
4           wherein the pure virgin copolymers are similar  
5           chemically to the homopolymer in the reinforced  
6           homopolymer nanocomposite material.

1       35. A reinforced homopolymer nanocomposite material with  
2           prespecified strength parameters as defined in Claim 34  
3           wherein the resultant reinforced homopolymer  
4           nanocomposite materials is formed into pellets.

1       36. An intravenous catheter or part thereof formed from  
2           thermoplastic reinforced polymer tubing wherein the  
3           ductility thereof is controlled by the relative amount  
4           of pure virgin polymer extruded with a nanocomposite  
5           reinforced copolymer.

1       37. An intravenous catheter or part thereof formed from  
2           thermoplastic reinforced polymer tubing as defined in  
3           Claim 36 wherein the flexibility of the intravenous  
4           catheter is further controllable by controlling the  
5           temperature of the pure virgin polymer and the

6 nanocomposite reinforced copolymer during extrusion.

1 38. An intravenous catheter or part thereof formed from  
2 thermoplastic reinforced polymer tubing as defined in  
3 Claim 36 wherein the flexibility is further  
4 controllable by multilayer extrusion.

1 39. A reinforced polymer blend formed by extruding a first  
2 nanocomposite polymer with a second nanocomposite  
3 polymer into tubing having an inside diameter of 0.001  
4 to 0.500 inches.

1 40. A reinforced polymer blend as defined in Claim 39  
2 wherein said first nanocomposite polymer includes Nylon  
3 6 and said second nanocomposite polymer includes a  
4 Pebax-based nanocomposite.

1 41. A reinforced polymer blend formed by extruding a  
2 nanocomposite polymer with a pure virgin copolymer into  
3 pellets.

1 42. A reinforced polymer blend formed by blending together  
2 a nanocomposite reinforced polymer and a virgin block  
3 copolymer to produce a resultant reinforced copolymer  
4 blend having a toughness greater than the toughness of  
5 the nanocomposite reinforced polymer and having a

6           toughness greater than the toughness of the virgin  
7           block copolymer.

1       43. A reinforced polymer blend as defined in Claim 42  
2           wherein toughness is a mechanical property calculated  
3           as the product of tensile strength and elongation to  
4           break rating.

1       44. A reinforced polymer blend as defined in Claim 42  
2           wherein the virgin block copolymer comprises Nylon  
3           based.

1       45. A reinforced polymer blend as defined in Claim 44  
2           wherein the virgin block copolymer comprises Pebax  
3           7233.

1       46. A reinforced polymer blend as defined in Claim 44  
2           wherein the virgin block copolymer comprises Pebax  
3           2533.

1       47. A reinforced polymer blend as defined in Claim 42  
2           wherein the nanocomposite reinforced polymer is Nylon  
3           based.

1       48. A reinforced polymer blend as defined in Claim 47  
2           wherein the nanocomposite reinforced polymer is based

3           on Nylon 12.

1       49. A reinforced polymer blend as defined in Claim 42  
2           wherein the strength and modulus of the resultant  
3           reinforced copolymer blend is maintained at a value  
4           intermediate between the strength and modulus values of  
5           the nanocomposite reinforced polymer and the virgin  
6           block copolymer.

1       50. A reinforced polymer blend as defined in Claim 42  
2           wherein said nanocomposite reinforced polymer includes  
3           nanoparticles of less than 20% by weight.

1       51. A reinforced polymer blend as defined in Claim 42  
2           wherein said nanocomposite reinforced polymer and said  
3           virgin block copolymer are blended together with equal  
4           amounts by weight.

1       52. A reinforced polymer blend as defined in Claim 42  
2           wherein said nanocomposite reinforced polymer has  
3           approximately 5% nanoparticles by weight.

1       53. A reinforced polymer blend as defined in Claim 42  
2           wherein the resultant reinforced polymer blend contains  
3           approximately 5% nanoparticles by weight.

1       54. A reinforced polymer blend as defined in Claim 51  
2               wherein the resultant reinforced polymer blend contains  
3               approximately 2.5% nanoparticles by weight.

1       55. A reinforced polymer blend formed by extruding a  
2               nanocomposite polymer with its analogous pure virgin  
3               polymer into tubing having an inside diameter of 0.001  
4               to 0.500 inches.

1       56. A method of producing a polymeric material with  
2               prespecified stress and strain parameters by diluting  
3               of a reinforced nanocomposite polymer blend with pure  
4               virgin thermoplastic polymers.

1       57. The method of producing a polymeric material with  
2               prespecified stress and strain parameters as defined in  
3               Claim 56 wherein the resultant produced polymeric  
4               material is extruded into tubular shape having an  
5               inside diameter of 0.001 to 0.500 inches.

1       58. The method of producing a polymeric material with  
2               prespecified stress and strain parameters as defined in  
3               Claim 56 wherein the resultant produced polymeric  
4               material is extruded into pellets.

1       59. The method of producing a polymeric material with  
2              prespecified stress and strain parameters as defined in  
3              Claim 57 wherein said extruding is performed within  
4              prespecified temperature conditions to produce the  
5              resultant polymeric material with prespecified stress  
6              and strain parameters.

1        60. The method of producing a polymeric material with  
2              prespecified stress and strain parameters as defined in  
3              Claim 59 wherein the extruding is performed at a  
4              temperature between 40 degrees to 100 degrees  
5              Fahrenheit.

1        61. The method of producing a polymeric material with  
2              prespecified stress and strain parameters as defined in  
3              Claim 56 wherein the reinforced nanocomposite polymer  
4              blend is a polyamide-based thermoplastic nanocomposite.

1        62. The method of producing a polymeric material with  
2              prespecified stress and strain parameters as defined in  
3              Claim 56 wherein the pure virgin thermoplastic polymer  
4              is Nylon-based.

1        63. The method of producing a polymeric material with  
2              prespecified stress and strain parameters as defined in  
3              Claim 61 wherein the polyamide-based thermoplastic

4                   nanocomposite is based on Nylon and the pure virgin  
5                   thermoplastic polymer is a polyether block amide.

1                 64. The method of producing a polymeric material with  
2                   prespecified stress and strain parameters as defined in  
3                   Claim 63 wherein the polyamide nanocomposite is based  
4                   on Nylon 11.

1                 60. The method of producing a polymeric material with  
2                   prespecified stress and strain parameters as defined in  
3                   Claim 63 wherein the polyamide nanocomposite is based  
4                   on Nylon 12.

1                 66. The method of producing a polymeric material with  
2                   prespecified stress and strain parameters as defined in  
3                   Claim 63 wherein the polyamide nanocomposite is based  
4                   on Nylon 6.